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NASA TECH BRIEF

Control of Component Differential Hardness Increases Bearing Life

The problem: In aircraft and space exploration vehicles maximum reliability is of paramount importance. The fatigue life of ball and roller bearings can be, and often is, a limiting factor in extending operating time. To increase operating time, it is necessary to develop bearings with maximum fatigue life.

The solution: Current bearing manufacturing practice generally specifies that bearings shall have balls or rollers of hardness equal to the hardness of the races. An extensive research program has shown that maximum fatigue life of bearings occurs when the hardness of the bearing balls or rollers is greater than that of the bearing races by an amount between one and two points as measured on the "Rockwell C" scale. When this difference in hardness is controlled within these limits, bearing life can be extended to four or five times that which is currently achieved in bearings with balls or rollers of the same hardness as the races.

How it's done: In initial tests, using the NASA-five-ball fatigue tester, groups of SAE 52100 steel inner bearing races tempered to nominal Rockwell C hardnesses of 60, 63 and 65 were stressed and run against groups of bearing balls of the same material and of varying hardnesses. The results indicated that, for a specific inner race hardness, rolling-contact life and load-carrying capacity of the test system reached a maximum as a function of the differential hardness, i.e., the ball hardness minus the race hardness, Δ H. The peak life-hardness combination occurred when this difference was between one and two points on the Rockwell C scale. Subsequent tests with standard bearings having a nominal race hardness of Rockwell C 63, with groups of balls of varying hardness, produced the same results.

Notes:

1. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B65-10251

Patent status: NASA encourages the immediate commercial use of this invention. It is owned by NASA, and a patent application has been filed. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C. 20546.

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